



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 4

61 Forsyth Street
Atlanta, Georgia 30303-3104

MEMORANDUM

March 31, 2011

4WD-TSS

SUBJECT: 2009 GW Monitoring Report for the Grenada Manufacturing Site
FROM: David N. Jenkins, Environmental Scientist
Technical Support Section, Superfund Support Branch
THROUGH: Glenn Adams, Section Chief, Technical Support Section, Superfund Support Branch
TO: Meredith Anderson, RCRA Project Manager
Meredith,

Enclosure 2

I have reviewed the 2009 monitoring report for the Grenada Manufacturing Site as you requested. Here are my comments. Please call me at 404-562-8462 if you have any questions.

The document reviewed is titled:

Brown and Caldwell, 2010, Annual Monitoring Report Calendar Year 2009, Grenada Manufacturing, LLC, Grenada Mississippi, Brown and Caldwell, 4000 Lakehurst Court, Dublin, OH 43019.

GENERAL COMMENT:

I have no previous experience with this site and have not reviewed any other reports for this site. You have asked for my evaluation of this report. As a basis for my evaluation, I assume that this report was provided to EPA to document the progress of the facility in managing groundwater contamination and the remedial measures implemented at the site. Given that remedial measures have been implemented, I expected to see presentations in the report that show some progress toward controlling the contamination and progress toward the ultimate cleanup goals. Regrettably, none of these things are shown in this report. There are no maps or graphs in this report which help you as the EPA Project Manager understand how the site is progressing. The maps which are in this report do not show the extent of contamination. There are no presentations in this report which would help you convince your management or the public that EPA is performing its responsibilities at this site.

The report contains 10 maps, 14 tables and 2 appendixes. The text describing this information is contained on 11 pages. The presentations in this report do not provide interpretations of the data. The report lists what was done during this monitoring year without reporting where the plume is, where it is going or how the remedy is functioning. The report does not show the remedial measures are protecting human health and the environment. In my opinion, interpretations like those described in this memo should be part of an annual monitoring report. There is no point in collecting the samples without interpreting the results. In my opinion, the experts who know the site best should do this interpretation.

EPA should expect reports for sites with remedies for groundwater contamination to contain maps and cross-sections which clearly show the extent of contamination (plumes) which can be compared from year to year to see if the plume area is shrinking. The plume maps should clearly demonstrate that no receptors are present within the plume and that the plume is under control.

EPA should expect reports for sites with remedies for groundwater contamination to contain contaminant concentration trend graphs which show the progress being made toward clean up. Contaminant concentration trends should be consistent with the performance expected for the remedy. Anomalies and unexpected trends should be evaluated to insure human health and the environment are protected and to determine whether modifications to the remedy are necessary or advisable. This is the purpose of collecting post-remedial action samples.

EPA should expect monitoring reports to clearly show that the remedy is working. This report does not do that. Consequently, the observations made in this memo regarding the distribution of contamination in groundwater, regarding contaminant concentration trends versus time and other observations are based on the contents of this report only and do not utilize maps, graphs or other data which may be in other reports. But in this report, the performance of the Permeable Reactive Barrier (PRB) in terms of reducing contamination and controlling contaminant migration from the site is not clearly demonstrated. The data

in Tables 5, 7 and Figure 5 suggest high levels of TCE concentration are migrating in groundwater toward the PRB wall. This same data suggests TCE contamination may migrate around the north and south end of the wall. There is no way to evaluate whether TCE contamination moves under the wall with the data presented, but as shown in this memo, the TCE trend in MW14 which is near the surface water stream and down gradient from the PRB wall is very strange. TCE concentrations in this well are high and TCE exceeded the MCL in surface water at SW9 and SW19 during the time covered by the 2009 Monitoring Report (Table 11).

COMMENT REGARDING THE REPORT SUMMARY SECTION 4:

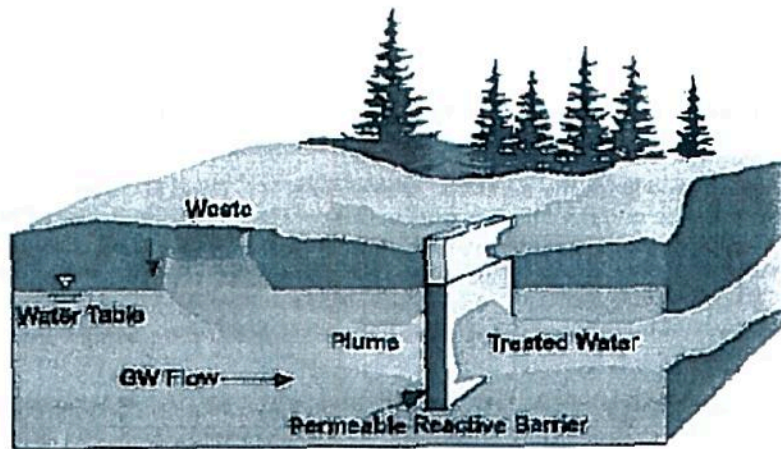
The summary of the report presented in Section 4 is only half of a page long. The summary is concise and subtle, but most importantly, the summary is honest and generates cause for concern regarding how the remedy is working. The summary (page 4-1) consists of 6 bulleted items which should be read in along with my interpretation of these 6 bullets presented below.

The first bullet in the summary states VOC concentrations have decreased or are stable, but no trend graphs are presented in the report to demonstrate the accuracy of this statement to EPA. If the statement is correct, stable VOC concentrations indicate there are no new impacts to receptors because the plume is not expanding. That is good as far as it goes, but stable concentrations do not show progress toward cleanup. Stable concentrations mean years after the remedy was implemented, conditions are no better or worse than they have always been. Again, the report does not present contaminant concentration trend graphs to support this statement regarding plume stability. Some of the graphs presented in this memo show contaminant concentrations are not stable but are increasing.

The second bullet of the summary makes 3 points:

- 1.) Bullet 2 states VOC concentrations inside the Permeable Reactive Barrier (PRB) are much lower than in wells up gradient and down gradient from the wall. The relevance of this point is unclear. The purpose of the wall is to remediate water which passes through it. Success is measured down gradient, not inside the wall.
- 2.) Bullet 2 states VOC concentrations down gradient from the wall are lower than up gradient from the wall. The relevance of this point is clear, but for reasons not given in the report, the contaminant concentration decrease from up gradient to down gradient is credited to the PRB wall only and not natural attenuation. There are no maps or graphs in this report which confirms that the PRB wall caused the contaminant concentration decreases with distance down gradient. Without plume maps from the current and previous years, there is no proof in this report that the wall has accomplished anything that would not have occurred without the installation of the wall.
- 3.) Bullet 2 states contaminant concentrations in some wells down gradient from the wall have not met the target levels. This is important because PRBs don't work on contamination which has already gone past the wall. Nothing in this report describes the fate of the untreated, uncaptured contamination. Natural attenuation is not mentioned as a remedy in this report. This report would not meet EPA requirements if Monitored Natural Attenuation (MNA) was the selected remedy, so there is no remedy in place for contamination which is already past the PRB wall. What is the remedy for contamination which is already down gradient from the wall?

Also regarding the second bullet, the effective life of a PRB wall is commonly 15-30 years. Porosity loss rates can be a few percent per year of the original available volume (Wilkin, R.T., 2005, Long-Term Performance Monitoring of Permeable Reactive Barriers for Groundwater Restoration, EPA ORD Waste Technical Seminar Series, March 2005). As porosity in the wall decreases due to precipitation of dissolved solids passing through the wall,



contaminated groundwater is more likely to be diverted around the wall rather than through it, so a PRB wall may become a dam and may fail to treat the whole plume as anticipated in the design long before the porosity is sealed completely. Without trend graphs showing contaminant concentrations versus time, it is not clear whether the wall will be effective long enough to treat the plume even if all contaminated water were flowing through the wall. Without water level hydrographs and detailed water level mapping, it is not clear whether the wall is in the correct place to capture all of the plume. Without cross-sections through the wall and an evaluation of well screen elevations, wall depth and vertical hydraulic gradients, it is not clear whether the wall is treating all of the plume or whether contamination is going under the wall or around the ends of the wall. (PRB sketch from Wilkin, R.T., 2005, Long-Term Performance Monitoring of Permeable Reactive Barriers for Groundwater Restoration, EPA ORD Waste Technical Seminar Series, March 2005).

The third bullet of the summary states sample results for inorganic (metals) analyses were stable compared to the 2003 base line results. If the concentrations are unchanged over 7 years, there has been no progress toward cleanup since 2003. It is not clear in this report whether the PRB wall was designed to treat metals contamination, though it probably was designed for metals as well as VOCs as suggested in EPA guidance documents from that time (see for example EPA, 1999, "An In Situ Permeable Reactive Barrier for the Treatment of Hexavalent Chromium and Trichloroethylene in Ground Water: Volume 2", EPA/600/R-99/095b). But there are no maps in this report showing the current distribution of metals contamination in groundwater up gradient and down gradient from the wall, or maps which compare the current distribution with the results of previous annual reports. There are no maps in this report showing the distribution of parameters, such as pH, dissolved oxygen, sulfate, etc., which often control or help explain the mobility of metals in groundwater.

The fourth bullet of the summary states VOC concentrations around the Equalization Lagoon have been stable compared to the 2003 baseline event. Again, the report does not present contaminant concentration trend graphs to support this statement regarding plume stability, but it is surprising that current VOC concentrations are comparable with concentrations from 6 years ago. This is not good news. While MNA is not the remedy in-place at this site, VOCs always degrade or dilute in the environment through natural processes, so current VOC concentrations should not be stable and comparable with the 2003 baseline event. The rate of degradation depends on many factors including the physical properties of the specific contaminants, the conditions at the site and the concentration of the contaminant. There no information about site specific degradation rates for VOCs at the Grenada Manufacturing site in the 2009 Monitoring Report. A study of TCE degradation in groundwater at DOE sites in the U.S. "... indicated that TCE was degraded in 9 of the 14 plumes examined, with first order degradation half-lives ranging from approximately 1 year to approximately 12 years." (R.C. Starr, 2005, <http://www.oefl.gov/enemrcitations/servlet/doi/10.2131-8SubVP/852131.pdf>). Experience with natural attenuation at other sites in EPA R4 during the last few years has shown that sites where VOC concentrations are not degrading at a rate consistent with a first order degradation rate are sites where source control and source removal has been ineffective or incomplete. Six years passed between the 2009 samples and the 2003 baseline sample event. If the VOC concentrations at the Grenada site are still comparable with the 2003 baseline event, then natural attenuation cannot control the plume and is not a suitable remedy for the site, so other effective remedial measures must be in place. Please note that this statement does not mean that EPA believes that natural attenuation is not working at the site. There is plenty of evidence of natural

attenuation in Table 5. But the rate of natural attenuation is less than the rate of contaminant migration. The VOC plume at this site cannot be contained by natural attenuation.

The fifth bullet of the summary states wells RT-2 and RT-4 have been impacted by something. The nature and cause of the impacts is unspecified. The fifth bullet of the summary cites statistical comparisons of parameters regarding Wells RT-2 and RT-4. Wells RT-2 and RT-4 are far up gradient from the PRG wall and will not be affected by that remedy. The 5th bullet concludes that the impacts at wells RT-2 and RT-4 "... are comparable to historical events", so something is happening in this area which is not under control by the PRB, but neither the impacts nor the historical events are identified in the bullet.

The sixth bullet states TCE, cis-DCE and vinyl chloride concentrations in surface water are increasing. The surface water sampling points are down gradient from the PRB wall. Dilution and oxidation in surface water as well as degradation along the flow paths between the source areas and the discharge areas makes detection of these substances in surface water near a site relatively rare. Clearly, contamination from this site is overwhelming these processes. The detection of these substances in surface water down gradient from the PRB wall suggests the wall is not performing as anticipated during the design (See Bullet 2 Point 3 above).

The sixth bullet also states concentrations of hexavalent chromium exceed Chronic Aquatic Life Criteria at all 4 down gradient surface water sampling locations. Natural processes down gradient from the PRB wall are not protecting the surface water from contamination by this site, and no other remedy is in place.

Page 1 Section 1 of the 2009 Groundwater Monitoring Report states this Groundwater Monitoring Report is part of a program to "... provide a means to evaluate the current groundwater conditions and effectiveness of the various corrective measures at the Site." Contaminated groundwater plumes are expanding. Surface water is impacted at concentrations which may be detrimental to aquatic life. As summarized in Section 4 of the report and as described in the comments of this memo, "... the various corrective measures at the Site" are not controlling groundwater contamination.

COMMENT REGARDING DATA PRESENTATION AND DATA INTERPRETATION:

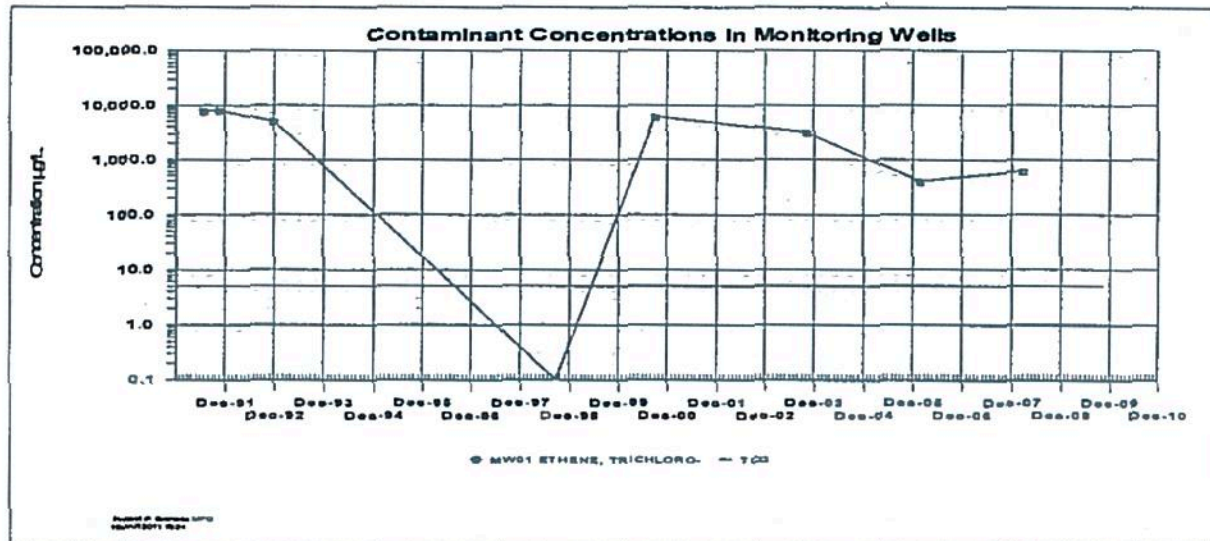
The report is an annual monitoring report, but no map or graph in this report indicates whether human health and the environment are protected by the remedial measures implemented at this facility. The extent of contamination is not shown on any map in the report. The extent of contamination observed in previous years is not shown on any map in the report. Monitoring wells in a shallow and deeper aquifer are sampled, but the relationship between the shallow and deep well screens and the depth of PRB is not shown on any cross-section in the report. Water level data is presented, but the data are not utilized to define vertical hydraulic gradients. The depth of the PRB wall is not mentioned in the report and it is not clear whether the wall fully penetrates either the shallow or deeper aquifer. The figures in the report do not show whether contamination is passing through the wall as intended in the design, beneath or around the ends of the PRB wall.

COMMENT REGARDING DATA TABLES AND DATA INTERPRETATION:

The metals analyses at well MW20 shown in Table 7 p.6/15 include the results from 6 samples collected between 1993 and 2008. Both arsenic and lead in the first two samples and the last sample exceeded the MCLs for these metals. No metals were detected in the three samples collected between the first two and the last sampling event. These "non-detect" results are marked with "U" qualifiers in Table 7. The detection limits for the middle samples (2003 and 2006) is not given on the table. Because the first and last samples exceeded the MCLs for arsenic and lead, it seems possible that metals exceedances occurred in the middle sample events also. The detection limits for the middle samples may have been elevated above the MCLs, so the results from a sample which exceeded the MCL would be reported as not detected.

Many of the VOC results in Table 5 also are marked with "U" qualifiers without numerical detection limits. Contaminant concentration trend graphs for VOCs created using the data in Table 5 shows the samples with some of these non-detect results probably contained significant levels of contamination. For example, TCE was not detected in the sample collected from well MW-1 during October 1998 (Table 5

page 1/9). The data from MW-1 plotted on the graph below suggests that the TCE concentration in October 1998 probably was much greater than the target cleanup level (TCL) of 5µg/L, but Table 5 show this result for this sample simply with a "U" qualifier. The TCE concentration in the October 1998 sample from well MW-1 is unknown. A very low TCE concentration (0.1µg/L) was used to represent the October 1998 sample event in the graph below.

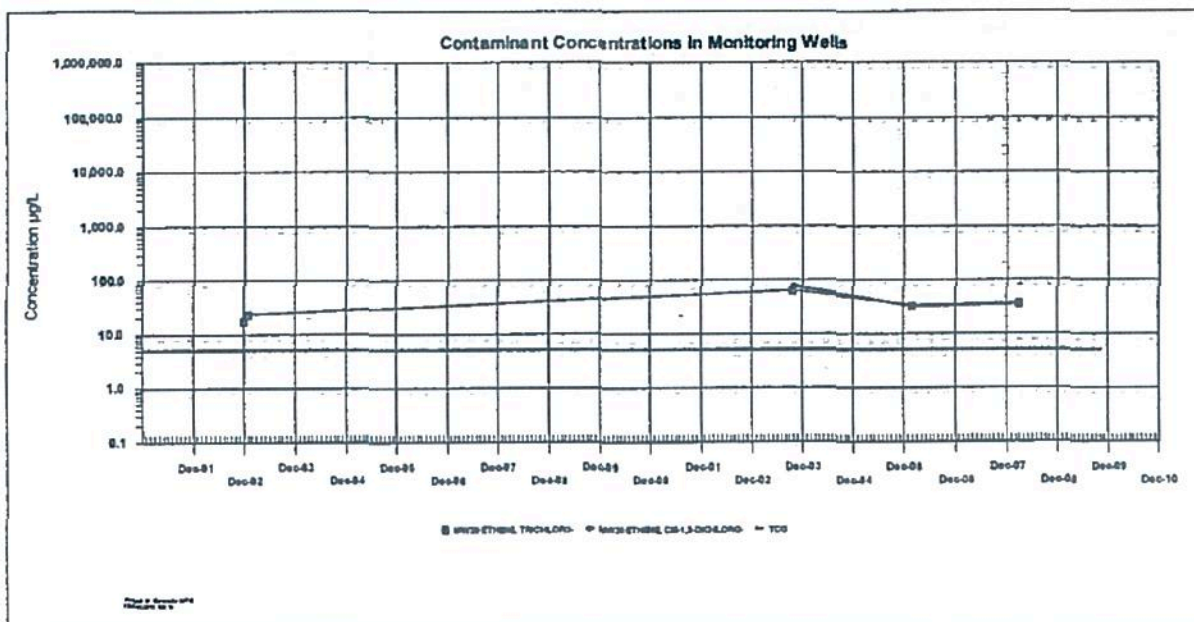


This graph shows why none of the laboratory results in Tables 5, 6 or 7 which are marked only with a "U" qualifier can be assumed to be non-detect at concentrations below a target cleanup goal. Please note that a TCG in the graph like the one above may be an MCL, a State ARAR or a site-specific Remedial Action Objective from a ROD concentration depending on the contaminant.

Non-detect samples from recent sample events are appropriately marked in these tables with a "U" qualifier accompanied by the numeric value of the detection limit for that specific sample. The detection limits from recent sample events appear to be less than the appropriate TCL for each contaminant, but the graph above shows this cannot be assumed to be the case for older samples. The "U" qualified samples in Tables 5, 6 and 7 serve as markers that a sample was collected, but should not be used for any other purpose. The "U" qualified results in Tables 5, 6 and 7 must not be interpreted as being results from uncontaminated samples.

COMMENT REGARDING OFF-SITE GROUNDWATER CONTAMINATION:

Contamination appears to have migrated off of the Grenada property beyond well MW20. Contaminant concentrations in well MW20 are shown in the report tables, but not on Figures 8 through 10 of the report. TCE concentrations in MW20 exceed the MCL and are increasing. DCE and VC are detected, but typically do not exceed the MCL. Some analyses were not conducted on the earlier samples. These are marked as "NA" in Table 5. Others are marked with "U" qualified results and no detection limit, so there is nothing to plot. The most recent TCE concentration is higher than the results in this well from early 1992, indicating the plume is expanding at a rate which exceeds the rate of natural attenuation.



Arsenic, lead and total chromium concentrations in MW20 have exceeded the MCL in the past. Relatively little data regarding metals concentrations in this well is available (Table 7 p.6/15). Iron, manganese and sulfate results are not shown in Table 7. These results, along with pH, conductivity, dissolved oxygen, oxidation-reduction potential (ORP) and turbidity should be shown on the metals analysis table to provide the data needed for interpretation of these results. Some of the parameters in this last group are presented in Table 8, but the data do not appear to be utilized anywhere in the report to interpret the sample results and the distribution of contamination.

The extent of groundwater contamination around well MW20 is not shown in this report.

COMMENT REGARDING LNAPL AND DNAPL:

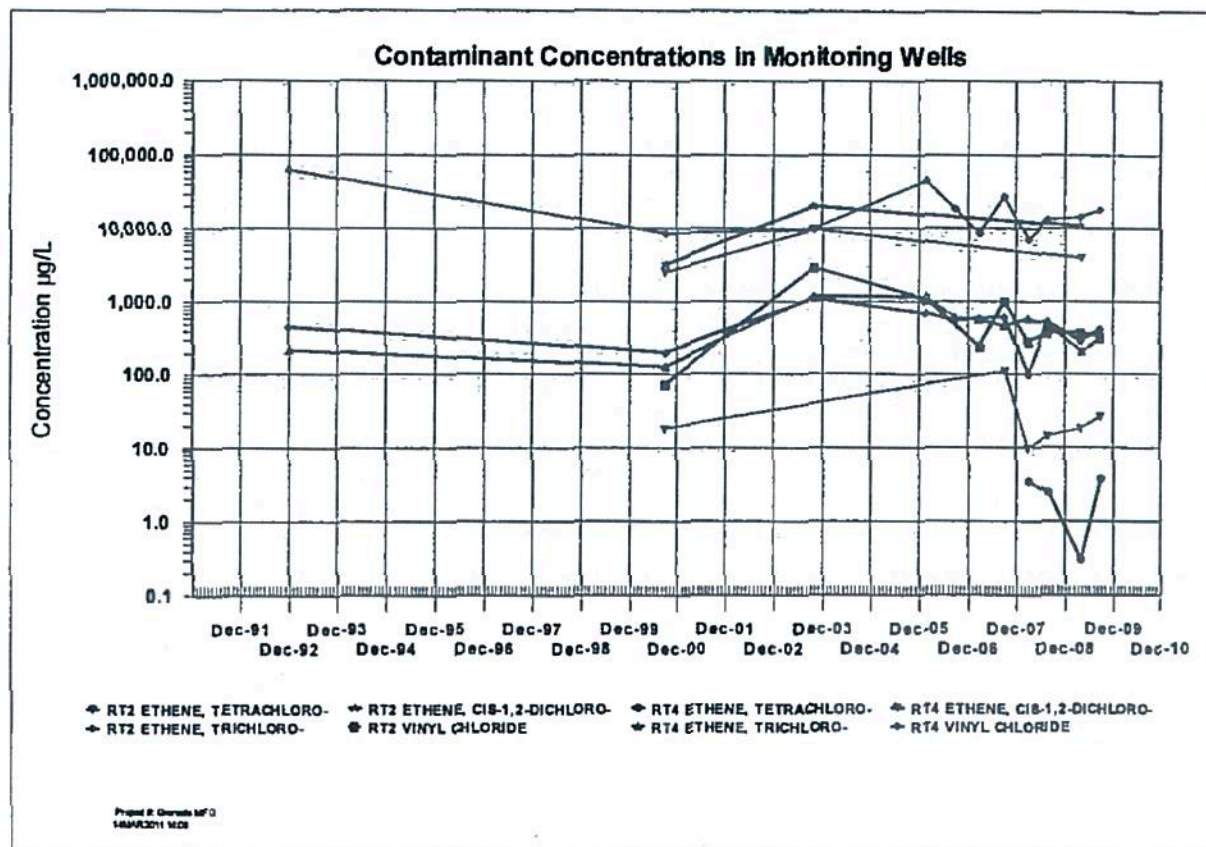
LNAPL is mentioned in the report (pages 1-2 and 2-1). Many contaminants can become LNAPL when released into the environment, but the contaminants in this specific LNAPL are not named in the report.

DNAPL is never mentioned in the report even though a primary VOC contaminant, TCE, always originates as a DNAPL. TCE has been reported to be present at the site at concentrations of nearly 700 mg/L (Table 5 p.1/9). "Rules of Thumb" used to indicate possible the presence of DNAPL in groundwater are between 1 and 10 percent of the solubility. TCE concentrations in well MW-2 have exceeded 60% of the solubility limit of TCE. DNAPL source material probably still exists in this aquifer.

The following graph shows chlorinated VOC concentrations in wells RT-2 and RT-4. This graph was made from the data in Table 5, but the report does not contain any trend graphs. Please note the graph must be viewed in color to be useful because 4 contaminants from 2 different wells are plotted. The graph is busy, but purpose of this particular graph is to illustrate overall trends only. Two important observations to be made from this graph are:

- 1.) the concentrations in many wells exceed the relevant MCLs, and
- 2.) concentrations are not decreasing.

The last point can be verified with a ruler to draw a horizontal line across the graph. The oldest analysis result for many of these contaminants is less than the youngest result, showing that contaminant concentrations are increasing over the last 10-18 years despite any degradation by natural attenuation. The graph does not show a meaningful decrease in contaminant concentrations versus time.



The vinyl chloride concentration in RT-2 is a good example of increasing contaminant concentrations. In this case, the increase could be the result of degradation of other cVOCs, but the most recent vinyl chloride concentration is more than oldest VC concentration in this well. The most recent VC concentration in RT-2 is 150 times greater than the MCL. cis-DCE concentrations have increased in both wells and have exceeded the MCL since they were sampled first in 2000. The TCE concentration in RT-2 has increased since 2000 and, as shown on the graph, this increase probably is not due to degradation of PCE. Even the concentrations which are decreasing are decreasing at rate too slow to result in cleanup in a reasonable time. An average trend line through these data would be nearly flat and relatively little degradation is apparent over a time period probably equal to a few TCE half-lives.

COMMENT REGARDING BIOREMEDIATION AND MONITORED NATURAL ATTENUATION (MNA):

Based on the type of contaminants (VOCs, sVOCs and metals) listed in Tables 5 and 7, and the use of the word "Bioremediation" in the title of Table 8, some proposal advocating a Monitored Natural Attenuation Remedy for this site may be under consideration. The conclusions of the previous comment show that MNA would not be able to clean this site in a reasonable time and is not a viable remedy for this site. Further, without well locations and well construction data, without trend graphs showing contaminant concentrations versus time, without maps showing the extent of contamination and without water level elevation contours in map and cross-section view showing groundwater flow directions, the data presented in this report cannot be used to support any remedy of any kind. The data presented do not follow EPA guidelines for characterization of contaminated sites. The data presented do not permit an evaluation of whether any of the monitoring well screens are located in the right places and correct depths relative to contaminant sources and groundwater recharge and discharge areas. The data presented in Table 8 do not appear to be utilized anywhere in this report to interpret the sample results and the distribution of contamination.

COMMENT REGARDING NAPL COLLECTION DATA TABLE 14:

The free product thickness measured in the November 2009 sample event was nearly 3 feet in wells RT-2 and RT-4 (Table 14). The product thickness in these wells is similar to the thickness in 2004. The product recovered during all of 2009 was less than 4 gallons (Table 14). I have no details regarding the source, the composition of the product or the method of product recovery. Product recovery has been underway for 6 years, and it appears little progress toward cleanup is being made because the NAPL thickness is about the same as it was in 2004. There does not appear to be any effective remedy or control on the DNAPL plume.

COMMENT REGARDING METALS ANALYSIS RESULTS IN GROUNDWATER TABLE 7:

Table 7 shows MCL exceedances in groundwater for arsenic, total chromium, and lead. The table also shows EPA Risk-based screening level (RSL) exceedances for chrome⁺⁶. Results for iron, manganese and sulfate are not reported on this table, but they should be. Specific conductance, pH and turbidity can be indicators of high metals concentrations in groundwater. These parameters are not reported on Table 7, but they should be. Some of these parameters are presented in Table 8, but Table 8 is organized differently from Table 7 and interpretation would be difficult in this form. All of the parameters described in this paragraph should be mapped and contoured to show relationships between the distribution and migration pathways. No maps of these data were presented for this review.

COMMENT REGARDING VOC AND METALS ANALYSIS RESULTS IN SURFACE WATER TABLES 11 AND 12:

Table 11 and 12 show concentrations of chrome⁺⁶ in surface water can sometimes exceed the EPA Risk-based screening level (RSL) for chrome⁺⁶ in groundwater. This is a concern because the surface water concentrations are diluted by flow from up stream. The concentrations in groundwater flowing to the surface water body must be much higher, and the ecological impacts on biota in the stream bed must be greater than indicated by these surface water concentrations.

Table 7 shows Total Chromium and chrome⁺⁶ in groundwater sometimes exceed the MCL or the RSL. Again, without maps, cross-sections, well construction information and trend graphs, a relationship between chromium in surface water and groundwater cannot be evaluated. The source areas and contaminant migration pathways to the stream are not shown in this report.

COMMENT REGARDING WATER LEVEL ELEVATION CONTOURS:

Figure 5 shows the 173 foot water level goes through lagoon as if it wasn't there. It isn't clear in this report whether the lagoon has been filled in or if the lagoon contained water at the time of sampling during 2009. If the lagoon contained water in 2009, it is unlikely that the water levels around the lagoon were not affected by leakage from the lagoon. The leakage would create a mound on the water table which would alter groundwater flow and contaminant migration directions. The water level contours on Figure 5 do not show any water table mound beneath the lagoon. If the lagoon was filled in and closed by 2009, groundwater flow and contaminant migration directions under pre-filling conditions might need to be considered to explain the distribution of contamination. A water table mound beneath this and any other lagoon, pond or ditch on the site would change groundwater flow directions and contaminant migration directions.

Current and historic leakage from these areas must be considered when interpreting contaminant distributions in groundwater beneath this site. This would be much easier if water level contour maps from each sample event were used as base map for a plume map showing the distribution of contamination based on the samples from each sample event. Changes in groundwater flow directions due to lagoon filling or other causes would be apparent in the water level contours and would be expected to produce a change in plume shapes. No plume maps are presented in the current report.

The water level contours on Figure 5 are unaffected by what appear be wetlands in the SW portion of the site. Wetlands can alter groundwater flow directions, change contaminant pathways from groundwater to surface water, and may even cause phyto-remediation of VOCs. Organic carbon in sediments along the flow path to a wetland can take up metals contamination.

Most importantly, the groundwater contours on Figure 5 are drawn through the PRB wall as if it wasn't there. The 165, 166 and 167 foot contours all cross the wall. It seems unlikely that this interpretation can be correct. Further, the shape of the PRB wall, the shape of the water level contours and the path of the stream all suggest that contamination may be migrating around the ends of the walls. Additional water level measuring points probably will be needed around the ends of the wall and perhaps deeper along the front and back of the wall. Staff gauges should be installed in the lagoons, ditches and wetlands at the site to correlate surface water levels to shallow groundwater levels to define the relationships between the contaminant plumes in groundwater, the surface water bodies and the PRB at this site.

COMMENT REGARDING TABLE 5 VOC RESULTS:

There is something wrong with the last row of data for MW-4 in Table 5. The table presents two different rows of data from October 1998 (Oct. '98) for well MW04. Some of the results in the two rows are similar, but the two TCE results disagree greatly.

The second occurrence labeled "Oct. '98" is out of order and is not marked as being a duplicate. I suspect the second occurrence labeled "Oct. '98" is actually data for October 2009. Table 9 shows the depth to water in MW04 was measured on October 26, 2009. Perhaps the second row of data labeled Oct. '98 in Table 5 is actually from October 2009. If this is correct, the TCE trend graph for this well changes greatly because the last TCE result would be much higher than any previous result. For this memo, I am assuming that the correct date for the second sample from MW04 marked "Oct. '98" is really October 26, 2009. If this turns out to be incorrect, I will have to fix my graphs later. I recommend that the "Enable AutoComplete for cell values" function in Microsoft Excel should be turned off when creating this kind of table.

Note that Table 5 does not provide sample dates, only the month and year of the sample. All trend plots presented in this memo assume the wells were sampled on the 1st day of the month. But this assumption is not valid if laboratory results are to be compared with water level elevations, rainfall events or other factors which are measured in real time. Ultimately, Table 5 is not suitable for detailed trend evaluation. Complete sample dates should be presented in the table.

COMMENT REGARDING TABLE 7 INORGANIC RESULTS:

The page below is from the 2009 Groundwater Monitoring Report Table 7 p.13/15. The copy is poor but the table shows the hexavalent chromium result from well RT-2 in May 2009 was 0.000755 mg/L.

TABLE 7
RESULTS FOR DETECTED INORGANICS IN GROUNDWATER

Grenada Manufacturing Site
Grenada, Mississippi

Well Name	Sample Date	Well Type	Location	Parameter	Unit	Result	Limit	Exceeds Limit	Notes
RT-1	Oct. 2009	Flow	1	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-2	Oct. 2009	Flow	2	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-3	Oct. 2009	Flow	3	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-4	Oct. 2009	Flow	4	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-5	Oct. 2009	Flow	5	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-6	Oct. 2009	Flow	6	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-7	Oct. 2009	Flow	7	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-8	Oct. 2009	Flow	8	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-9	Oct. 2009	Flow	9	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-10	Oct. 2009	Flow	10	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-11	Oct. 2009	Flow	11	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-12	Oct. 2009	Flow	12	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-13	Oct. 2009	Flow	13	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-14	Oct. 2009	Flow	14	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-15	Oct. 2009	Flow	15	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-16	Oct. 2009	Flow	16	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-17	Oct. 2009	Flow	17	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-18	Oct. 2009	Flow	18	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-19	Oct. 2009	Flow	19	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-20	Oct. 2009	Flow	20	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-21	Oct. 2009	Flow	21	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-22	Oct. 2009	Flow	22	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-23	Oct. 2009	Flow	23	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-24	Oct. 2009	Flow	24	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-25	Oct. 2009	Flow	25	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-26	Oct. 2009	Flow	26	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-27	Oct. 2009	Flow	27	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-28	Oct. 2009	Flow	28	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-29	Oct. 2009	Flow	29	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-30	Oct. 2009	Flow	30	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-31	Oct. 2009	Flow	31	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-32	Oct. 2009	Flow	32	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-33	Oct. 2009	Flow	33	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-34	Oct. 2009	Flow	34	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-35	Oct. 2009	Flow	35	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-36	Oct. 2009	Flow	36	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-37	Oct. 2009	Flow	37	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-38	Oct. 2009	Flow	38	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-39	Oct. 2009	Flow	39	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-40	Oct. 2009	Flow	40	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-41	Oct. 2009	Flow	41	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-42	Oct. 2009	Flow	42	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-43	Oct. 2009	Flow	43	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-44	Oct. 2009	Flow	44	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-45	Oct. 2009	Flow	45	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-46	Oct. 2009	Flow	46	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-47	Oct. 2009	Flow	47	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-48	Oct. 2009	Flow	48	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-49	Oct. 2009	Flow	49	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-50	Oct. 2009	Flow	50	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-51	Oct. 2009	Flow	51	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-52	Oct. 2009	Flow	52	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-53	Oct. 2009	Flow	53	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-54	Oct. 2009	Flow	54	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-55	Oct. 2009	Flow	55	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-56	Oct. 2009	Flow	56	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-57	Oct. 2009	Flow	57	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-58	Oct. 2009	Flow	58	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-59	Oct. 2009	Flow	59	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-60	Oct. 2009	Flow	60	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-61	Oct. 2009	Flow	61	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-62	Oct. 2009	Flow	62	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-63	Oct. 2009	Flow	63	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-64	Oct. 2009	Flow	64	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-65	Oct. 2009	Flow	65	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-66	Oct. 2009	Flow	66	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-67	Oct. 2009	Flow	67	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-68	Oct. 2009	Flow	68	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-69	Oct. 2009	Flow	69	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-70	Oct. 2009	Flow	70	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-71	Oct. 2009	Flow	71	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-72	Oct. 2009	Flow	72	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-73	Oct. 2009	Flow	73	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-74	Oct. 2009	Flow	74	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-75	Oct. 2009	Flow	75	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-76	Oct. 2009	Flow	76	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-77	Oct. 2009	Flow	77	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-78	Oct. 2009	Flow	78	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-79	Oct. 2009	Flow	79	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-80	Oct. 2009	Flow	80	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-81	Oct. 2009	Flow	81	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-82	Oct. 2009	Flow	82	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-83	Oct. 2009	Flow	83	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-84	Oct. 2009	Flow	84	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-85	Oct. 2009	Flow	85	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-86	Oct. 2009	Flow	86	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-87	Oct. 2009	Flow	87	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-88	Oct. 2009	Flow	88	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-89	Oct. 2009	Flow	89	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-90	Oct. 2009	Flow	90	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-91	Oct. 2009	Flow	91	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-92	Oct. 2009	Flow	92	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-93	Oct. 2009	Flow	93	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-94	Oct. 2009	Flow	94	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-95	Oct. 2009	Flow	95	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-96	Oct. 2009	Flow	96	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-97	Oct. 2009	Flow	97	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-98	Oct. 2009	Flow	98	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-99	Oct. 2009	Flow	99	Hexavalent Chromium	mg/L	0.000755	0.01		
RT-100	Oct. 2009	Flow	100	Hexavalent Chromium	mg/L	0.000755	0.01		

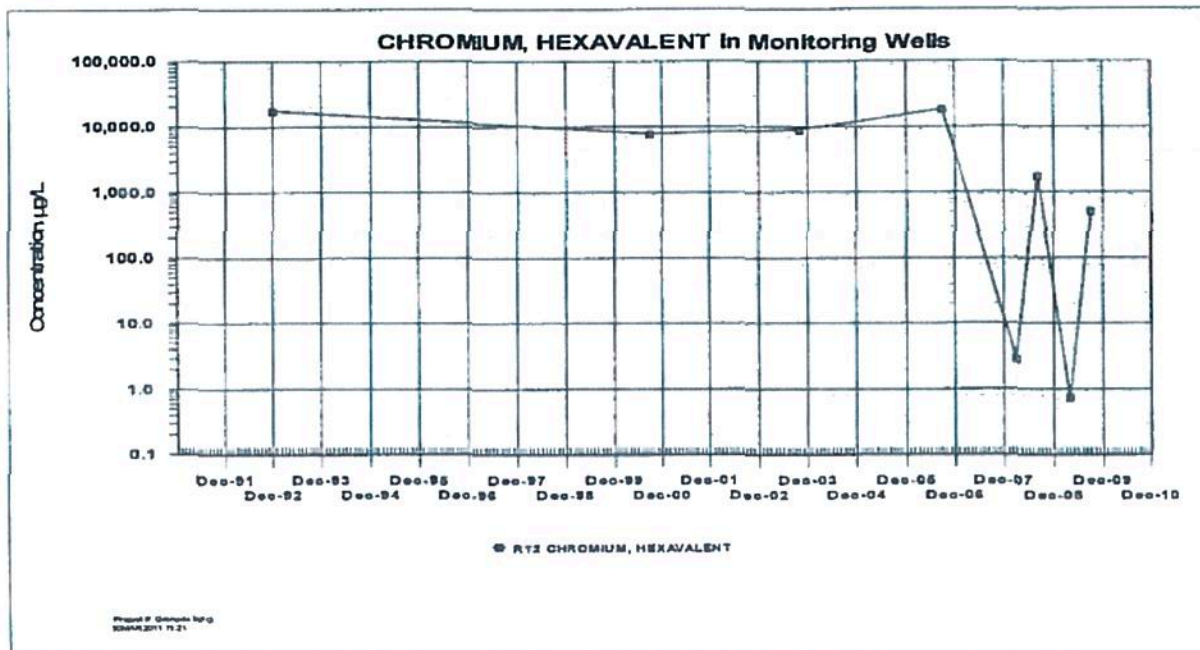
From CD in Appendix B, file Meritor WO #0905192 INORG.PDF, the laboratory report for this sample shows the hexavalent chromium result from well RT-2 in May 2009 was 0.755 mg/L.

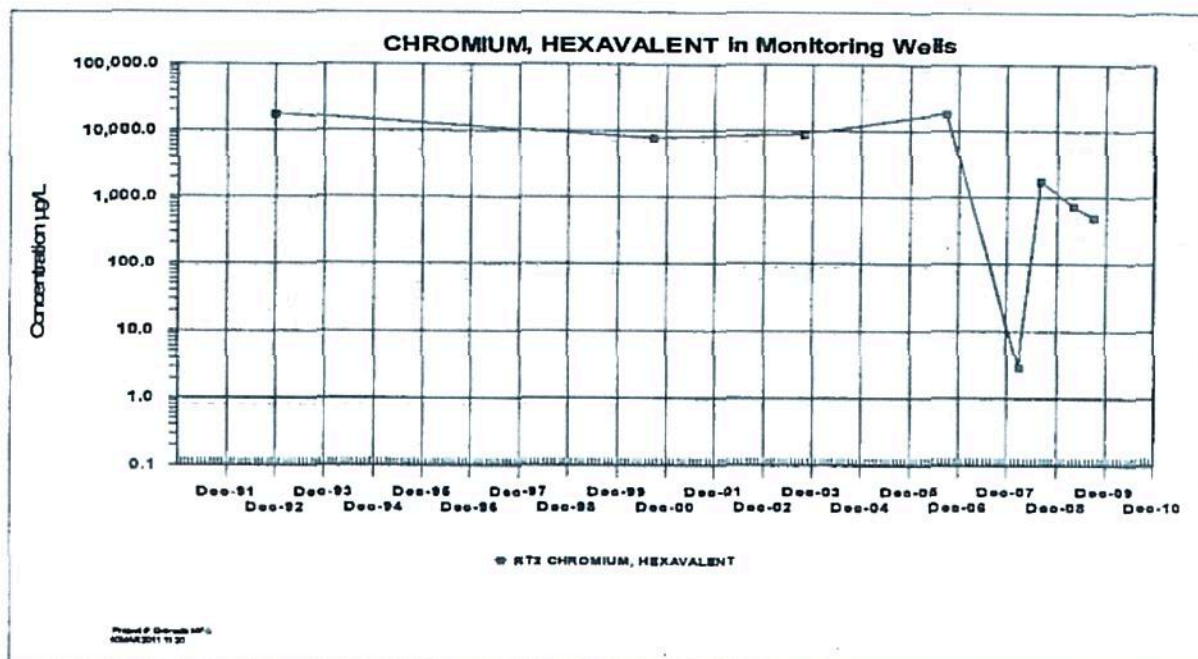
Client Sample ID: RT-2
Lab Sample ID: 0905192-07
Sample Matrix: Water

Sample Collection Date/Time: 05/20/2009 12:45
Sample Received Date/Time: 05/21/2009 08:00

Analyte	Result	MDL	RL	Units	Dilution	Analyzed	Method	Batch	Notes
Hexavalent Chromium by Spectrophotometer									
Hexavalent Chromium	0.755	0.200	0.500	mg/L	20	05/21/09 11:36	SW7196A	9E21004	D

The trend graphs below show the difference between these two results.





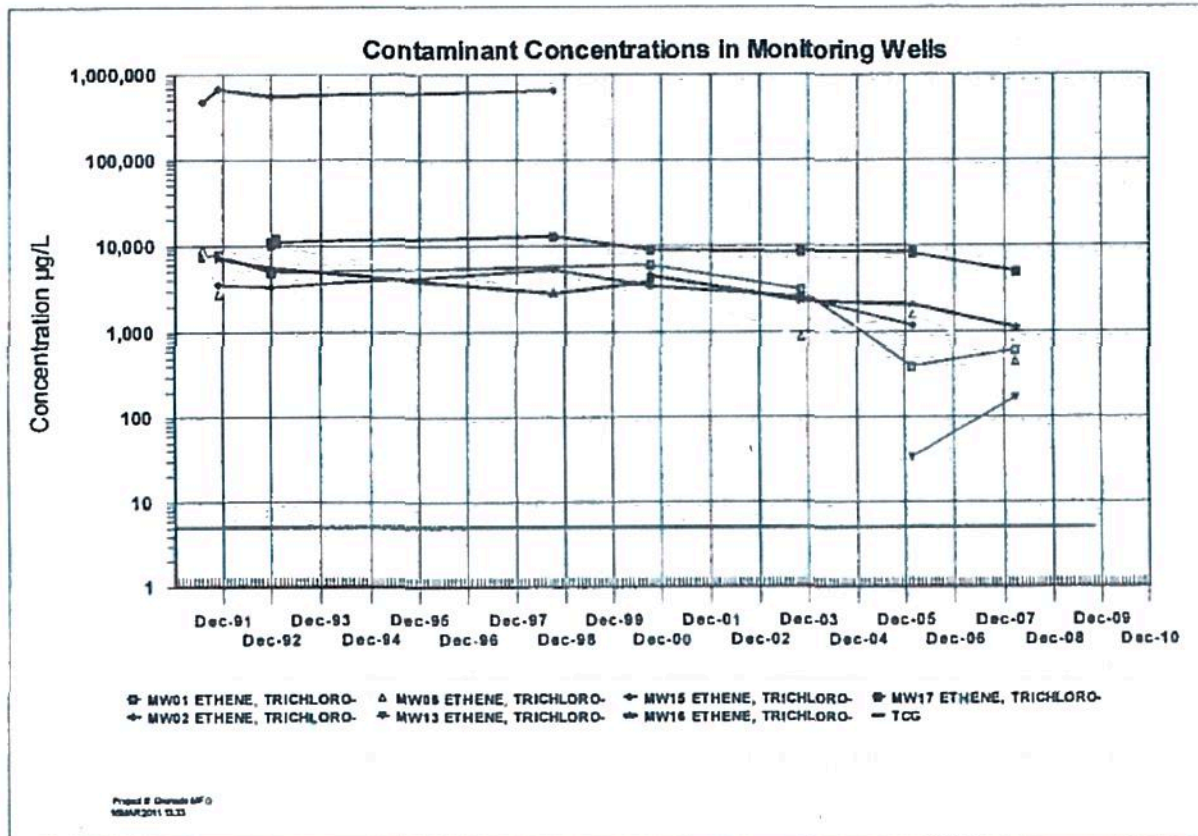
You can see that the second downward pointing spike on the first graph disappears on the second graph when the value reported from Appendix B is plotted instead of the value in Table 7. I do not have the laboratory results for 2008 and cannot check the other downward spike shown on the graph. The 2008 data does not fit the hex-chrome data trend for this well.

Other unit change errors may be present in Table 5 and Table 7. You should be cautious while making regulatory decisions regarding this site based on the data presented in the 2009 Groundwater Monitoring Report tables. Contaminant concentration trend graphs created from Tables 5 and 7 of the 2009 Monitoring Report show many erratic trend changes. Some of these erratic trends may be due to other concentration unit conversion errors like the one described above.

The detection limits are not presented in Tables 5 and 7 for many of the non-detect sample results. These results are simply noted with a "U" qualifier. Without the detection limit for that specific analysis, it isn't clear whether the detection limits were less than the target cleanup level. A "U" qualified sample without a numeric result in these tables might exceed a Maximum Contaminant Level (MCL). Regarding Table 5, many of the sample results have a "D" qualifier indicating that the sample was diluted to get the result shown. Some recent "U" results with numeric values exceed the MCLs, so it is likely that some of the older results without numeric values also exceeded the MCLs. Many more cells on Table 5 probably would have been highlighted. Most importantly, without trend graphs, it is difficult to see whether the plumes are expanding, receding or stable, and if the trends are erratic it can be hard to determine the status of the plume with trend graphs. Consequently, the statement in the first bullet of the summary (Section 4) that "... VOC concentrations generally have decreased or have remained stable since the baseline event in 2003" should not be used for making decisions about this site.

COMMENT REGARDING TCE UP GRADIENT WELLS:

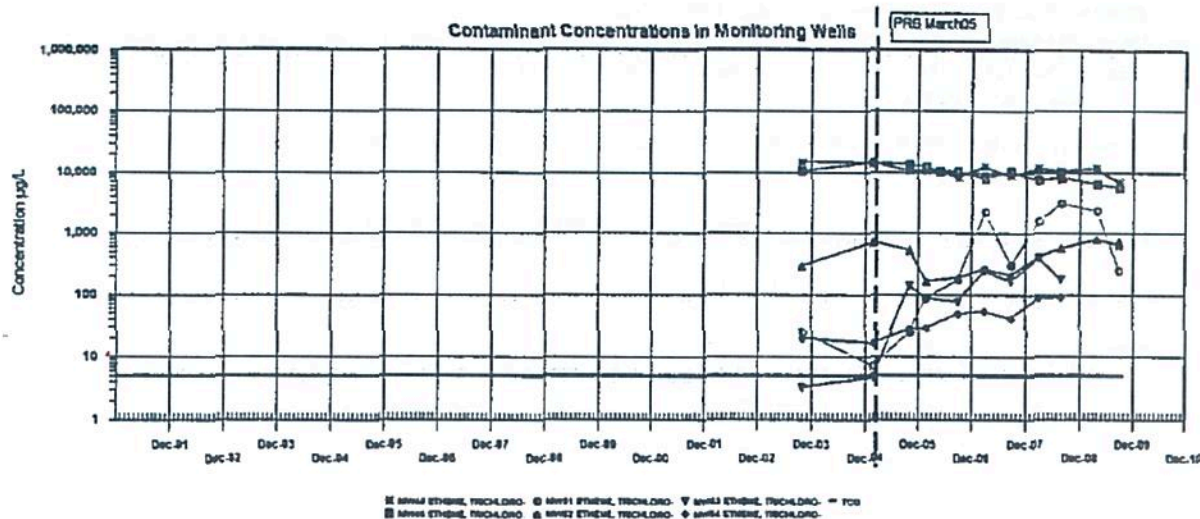
TCE concentrations in wells MW1, 2, 6, 13, 15, 16 and 17 from Table 5 are shown in the graph below:



All of these wells are hundreds of feet up gradient from the PRB wall (Figure 5). No figure in the report shows a TCE plume, but based on the TCE concentration in MW02 and the relatively stable TCE concentrations in MW17 over 15 years, the axis of this particular TCE plume is suspected to be in the upper zone near MW02. You can see that TCE concentrations in MW02 were very high when this well was sampled last in 1998. Well MW17 is located near this well, but MW02 is in the Upper zone while MW17 is in the Lower zone. TCE concentrations have decreased very little in MW17 since early 1993. Figure 5 shows there are no monitoring wells down gradient from MW02 and MW17 for at least 400 feet. The plume is migrating toward the PRB wall. The most contaminated portion of the facility has not been sampled since 1998.

The increasing TCE concentration in well MW13 is one piece of evidence that the margins of the plume are expanding northward (see the location of MW13 on Figure 5) and that the plume may flow around the north end of the PRB wall. There are not enough monitoring wells in the down gradient portion of this plume, particularly around the ends of the PRB wall.

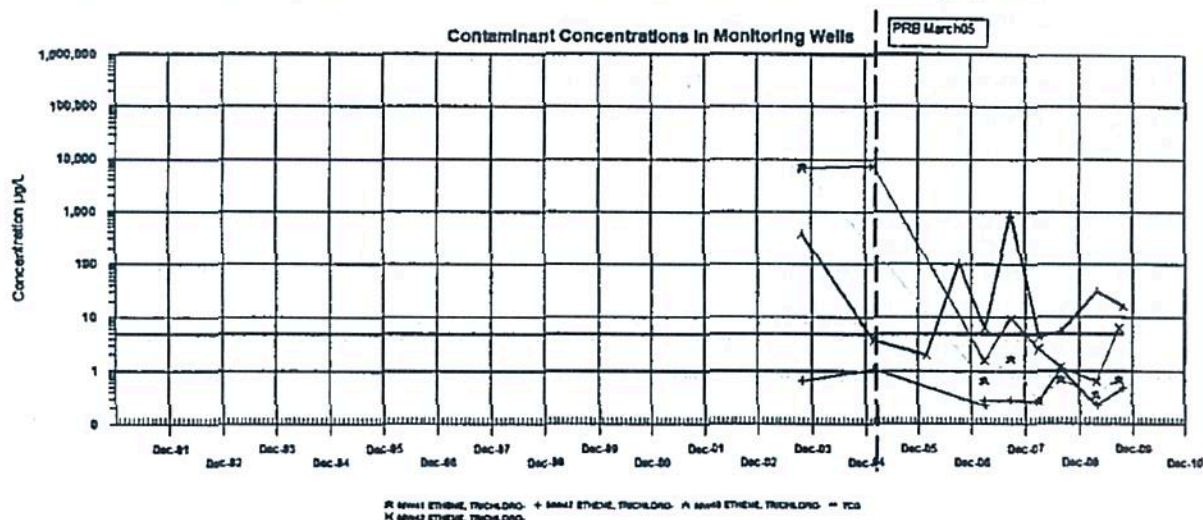
TCE concentrations in wells MW45, 46, 51, 52, 53 and 54 from Table 5 are shown in the graph below:



These wells are down gradient from the wells shown in the previous graph, but up gradient and relatively close to the PRB wall. Based on the relatively high and stable TCE concentrations, MW45 and 46 may be close to the axis of this TCE plume down gradient from MW02 and MW17. TCE concentrations in these wells are decreasing slightly, but are relatively stable, and are comparable with concentrations in up gradient well MW17 shown in the previous graph.

TCE concentrations in the deeper MW52 increased after 2006 and by 2009 became similar to concentrations observed when the wall was installed. TCE concentrations in the shallow wells MW51 and MW53 and deeper well MW54 all have increased since the PRB wall was installed. The increasing TCE concentration in these wells may be evidence that the margins of the TCE plume are expanding southward (see the well locations on Figure 5) and that the plume may flow around the south end of the PRB wall.

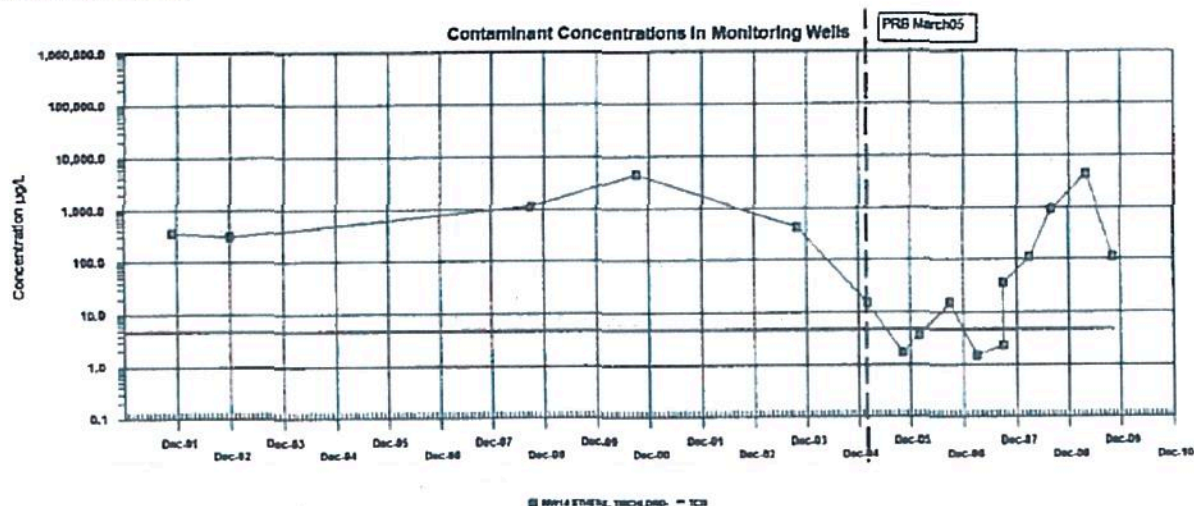
TCE concentrations in wells MW41, 42, 47 and 48 from Table 5 are shown in the graph below:



These wells are located down gradient from the PRB wall and away from the ends of the wall (see the well locations on Figure 5). TCE concentrations trends from these wells suggest the PRB wall lowered

TCE concentrations in these wells, though the concentration trend in deep well MW48 is erratic for reasons which are unclear at this time. The shallow well at this location, MW47, has never shown an exceedance for TCE. The erratic response in MW48 may be an indication that TCE contamination moves under the wall near MW48.

Unfortunately, on the down gradient side of the wall in MW14, the situation is even less clear as shown in the graph below.



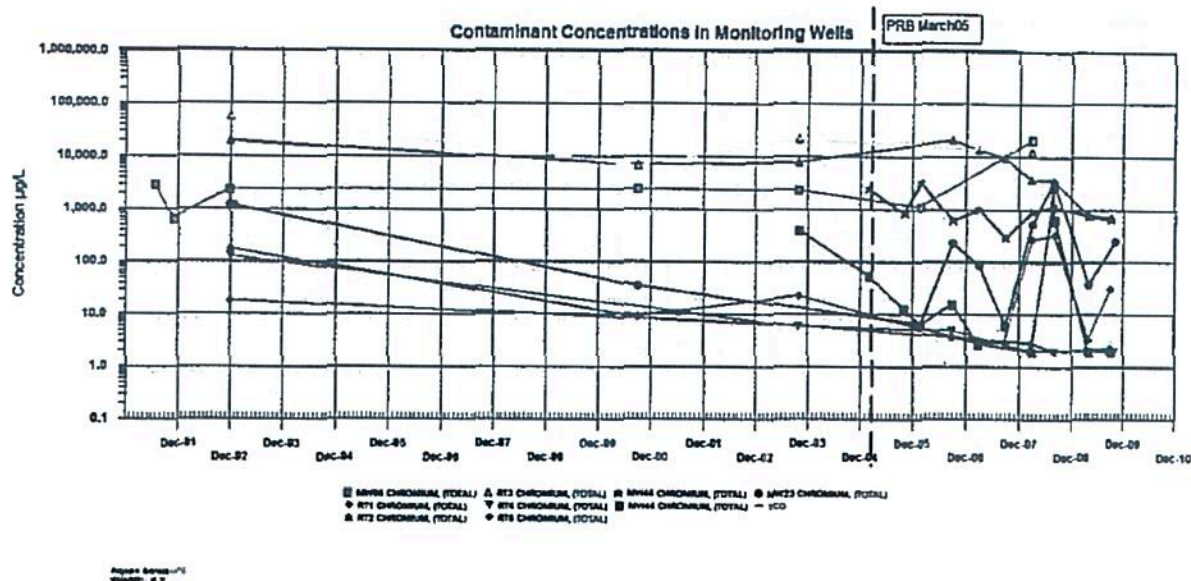
The PRB wall may not have had any influence on TCE concentrations in well MW14. TCE concentrations were decreasing before the wall was installed. Three years after the wall was installed, TCE concentrations in this well increased to levels previously observed in 2000. The cause of these concentration variations is not addressed in the 2009 Monitoring Report. What is clear from Figure 5 is that MW14 is much closer to the surface water stream than it is to the wall. The TCE plume from MW14 discharges to the stream in this area. Without well screen depth information, without estimates of the vertical hydraulic gradient near MW14 and the stream and without information regarding the depth of the PRB wall, further interpretation of these data is not possible.

COMMENT REGARDING METALS IN MONITORING WELLS:

ARSENIC: The data presented in Table 7 shows MCL exceedances for arsenic in many of the monitoring wells. Elevated arsenic concentrations are commonly found in and down gradient from chlorinated solvent plumes. The arsenic plume is not mapped in this report.

TOTAL CHROMIUM: The data presented in Table 7 shows total chromium exceedances occurred in many of the monitoring wells in samples collected in the early 1990s. Many of the sample results shown on Table 7 are non-detect results with "U" qualifiers at some unknown detection limit, so total chromium trends in most of the wells are unclear.

The MCL for total chromium is 100µg/L. Total chromium trends in selected wells are shown in the graph below and described in the following paragraphs.



Total chromium concentrations in MW06 have exceeded 1,000µg/L in 7 of 8 samples since 1991 and concentrations are increasing (Table 7 p.2/15).

Total chromium concentrations in the background well MW23 appear to be increasing, but the trend is very erratic for reasons not explained in the 2009 Monitoring Report. MW23 is the most up gradient well with MCL exceedances for total chromium, but with the erratic trend, the chromium source may be farther up gradient.

Total chromium concentrations in well RT3 have exceeded 10,000µg/L in all but one sample since the earliest reported samples in 1992.

Total chromium concentrations in well RT2 have exceeded 10,000µg/L in most samples before 2008, but recently have declined to 750µg/L.

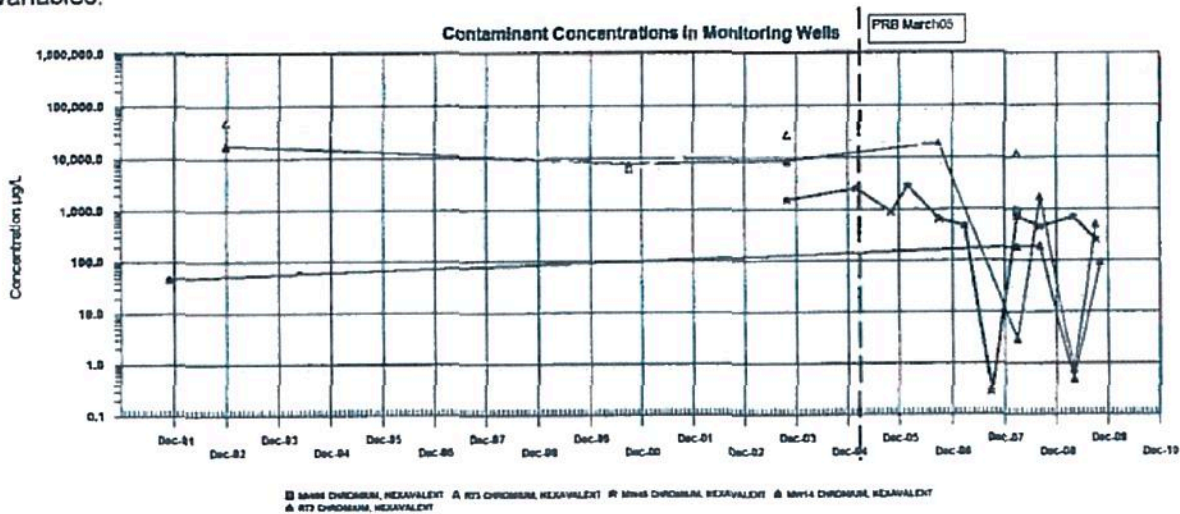
Total chromium concentrations in shallow well MW45 always exceed the MCL. Total chromium concentrations in well deeper well MW46 sometimes exceed the MCL, but the trend is erratic. The erratic trend in MW46 may be an indication that contamination sometimes passes under the wall at this location, but no information regarding the hydraulic gradients in this well pair is provided. Both of these wells screens are located relatively close to the PRB wall and are far down gradient from the RT wells.

Total chromium concentrations in well RT5 sometimes exceed the MCL, but the occasional exceedances are greatly different from the other results from this well. Turbidity in the sample might cause this response, but turbidity is not reported on Table 7.

Total chromium concentration in well RT1 has never exceeded the MCL and total chromium concentrations in well RT4 exceed the MCL only in January 1993. I first thought the old lagoon was the source of the chromium, but the typically low chromium levels in wells RT1, RT4 and RT5 suggest this is not true. MW23, RT2 and RT3 all are on the south side of the lagoon. The source of the total chromium plume is not clear from the data presented and the location of the plume is not shown on any map in this report. The extent of total chromium contamination in groundwater appears to extend from the PRB up gradient at least as far as MW23.

HEXAVALENT CHROMIUM: There is no MCL for hexavalent chromium. Elevated concentrations of hexavalent chromium, defined for this memo as greater than 10µg/L simply to identify wells with higher hexavalent chrome levels, are observed from most samples in wells MW06, MW14, RT2, RT3, MW45 and once in MW46 (not plotted below). MW14 is down gradient from the PRB where groundwater will not

be treated. The cause of the "W" pattern in the trend graph below is unclear. Possible causes include unit conversion errors, turbidity in the samples, laboratory problems and other sampling procedure variables.



LEAD: The data presented in Table 7 shows lead exceedances occurred in many of the monitoring wells in samples collected in the early 1990s. Many other sample results shown on Table 7 are non-detect results with "U" qualifiers at some unknown detection limit, so lead concentration trends in most of the wells are unclear. Only a portion of the wells were sampled for metals in 2009, and no exceedances for lead were observed. Some exceedances were reported for lead from the 2008 sampling event.

COMMENT REGARDING BACKGROUND MONITORING WELL MW23:

Background monitoring well MW23 is between the old lagoon and the main plant building. Background well MW23 is down gradient from contaminated wells RT-1 and the NAPL recovery wells near MW24. Background well MW23 has shown MCL exceedances for TCE, cis-DCE, vinyl chloride, 1,1-DCE, arsenic, total chromium and lead. The 2009 Monitoring report states on page 3-6 "Well MW-23 replaced RT-1 as a background monitoring well, as approved in the March 2001 permit revision." I do understand why EPA approved MW23 as a background well. This decision should be reevaluated.